Received: 15 October 2016 | Revised: 21 December 2016 | Accepted: 24 December 2016

DOI 10.1002/jso.24550

RESEARCH ARTICLE

WILEY Journal of SURGICAL ONCOLOGY

The role of oncoplastic breast reduction in the conservative management of breast cancer: Complications, survival, and quality of life

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BACKGROUND AND OBJECTIVES: Reduction Mammaplasty (RM) in breast cancer allows mammary remodeling after wide excisions. We aimed to analyze the complications, survival, and quality of life after RM.

METHODS: Retrospective study of women who underwent a surgical intervention for breast cancer between 2000 and 2016. Patients were divided into two groups: RM and tumorectomy. Postoperative complications, survival and quality of life were assessed using the Breast-Q questionnaire.

RESULTS: A total of 801 patients were evaluated, with a mean follow up of 84 months. RM patients experienced a longer operating time and hospital stay, and a higher proportion of tissue necrosis compared to tumorectomy patients ($P < 0.001$). No significant differences were observed regarding rate of re-excision or rate of mastectomy, but the recurrence rate at 10 years was higher for RM patients ($P < 0.03$). Patients who underwent RM reported optimal satisfaction with the breast and a good quality of life.

CONCLUSIONS: RM is a useful approach in breast cancer surgery, with a low rate of re-excision and mastectomy. Overall survival at 10 years is similar to that associated with tumorectomy, though with a higher rate of local recurrence. Patient satisfaction and quality of life appears to be good one year after radiotherapy.

KEYWORDS
breast-Q questionnaire, macromastia, multifocal/multicentric tumors

1 | INTRODUCTION

Conservative surgery is the procedure of choice for the operative management of women with breast cancer, and guarantees survival rates similar to those associated with mastectomy.[1–3] Tumorectomy is often performed in conjunction with oncoplastic techniques, as this allows reconciliation of oncologic and aesthetic practices, enabling contemporary tumor resection, and remodeling of the mammary defect.[4] Reduction Mammaplasty (RM) is a procedure that permits oncoplastic breast remodeling in women with multifocal tumors, improves cosmetic options in tumors located in the lower pole,[5,6] and optimizes breast irradiation in patients with macromastia.[7]

Several studies[8–12] have compared RM to tumorectomy in terms of postoperative complications, optimization of the surgical margins, and local recurrence, concluding that the former oncoplastic procedure improves surgical resection and is associated with a low rate of tumor recurrence. However, few studies have analyzed survival rates and long-term actuarial recurrence due to the majority having only a short follow-up period. This limits the availability of key information regarding the long-term evolution of RM patients,

including their overall survival rates, degree of local tumor recurrence, and frequency of metachronous tumors arising in the healthy breast. Moreover, there are a distinct lack of studies analyzing patient satisfaction and quality of life after RM.

The aim of the present study was to determine the impact of RM on care, survival, and quality of life in women who underwent this procedure at our breast unit, compared to those who underwent tumorectomy.

2 | PATIENTS AND METHODS

This was a retrospective analysis of data gathered between January 2000 and June 2016 on women with histologically confirmed invasive breast carcinoma/ductal carcinoma in situ (DCIS) who underwent a breast-conserving surgical intervention. Patients for whom mastectomy was the primary intervention or who did not give their consent to participate in the study were excluded. Two patient groups were established: a study group consisting of patients who underwent RM, and a control group consisting of patients who underwent tumorectomy. The study was approved by the research ethics committee at our hospital and assigned the identification code *BreastQ-15*. All patients signed an informed consent document specific to their participation in this study.

2.1 | Surgical technique

According to guidelines, tumorectomy with local reconstruction was indicated in women with tumors smaller than 3 cm at diagnosis or after neoadyuvant chemotherapy, in locations associated with a low risk of deformity. RM is indicated in women with multifocal tumors requiring extensive mammary resection, tumors located in areas associated with a high risk of deformity (inferior pole, upper inner quadrant), patients with poor breast/tumor ratio and patients with macromastia. In the present study, RM was performed using a vertical, Wise pattern. Selection of the pedicle depended on (1) the location of the tumor requiring resection and (2) the distance between the nipple-areola complex and its future location in the newly structured breast. All patients in the study group were offered symmetrization of the healthy breast using the same pattern. All patients included in the present study received breast radiotherapy using tangential fields at a dose of 50 Gy (25 fractions of 2 Gy). In the case of tumor bed overprinting, this dose was increased by 8-10 Gy.

2.2 | Assessment of satisfaction and quality of life

All patients in the study group received the BREAST-Q™ Post-Operative Reduction Module (mastopexy) questionnaire between 12 and 24 months after completion of radiotherapy.[13] The final score was calculated with the Q-Score software, which has a range of 0-100 (where a higher score indicates a greater satisfaction). All patients signed an informed consent document specific to their participation in this study.

2.3 | Outcomes analysis

Overall survival was defined as the percentage of patients still alive 10 years after diagnosis, with death from all causes recognized. Disease-free survival was defined as the percentage of patients still alive 10 years after diagnosis who did not relapse during this time. All relapses were confirmed by histology.

2.4 | Statistical analysis

A descriptive analysis of data from all patients included in the study was performed. This was followed by a subsequent comparative analysis comparing women in the study group to those in the control group. Quantitative variables are expressed as mean ± standard deviation and qualitative variables are expressed as absolute value and percentage. Possible associations between qualitative variables were assessed using a chi-square test. Comparison of means (once checked for normality) was performed using a Student's *t*-test or Mann-Whitney U test, as appropriate. Both the probability of relapse (locoregional or distant) during follow-up and overall breast cancer survival at 10 years were assessed using Kaplan-Meier curves, along with the Log Rank test.

3 | RESULTS

A total of 1,439 patients underwent a surgical procedure during the study period, of which 801 met the inclusion criteria. The final study group (RM) consisted of 170 patients, while the control group (tumorectomy) consisted of 631 patients.

3.1 | Patient characteristics

Table 1 summarizes the clinical characteristics of patients included in the present study. Compared to patients who underwent tumorectomy, those who underwent RM were generally younger and had tumors that were more frequently multifocal or located in the lower pole. The average operating time was significantly longer for RM than for tumorectomy patients ($P < 0.001$). The time elapsed between completion of the intervention and initiation of radiation or chemotherapy was not significantly different between study and control groups, except in patients with DCIS or invasive carcinoma who did not receive adjuvant chemotherapy. Within this subset, the start of radiation therapy was significantly delayed for patients who underwent RM compared to those who underwent tumorectomy ($P < 0.001$). Although a radiation *boost* targeting the tumor bed was not indicated more frequently in RM patients compared to tumorectomy patients, a higher proportion of the former group did require axillary or supraclavicular irradiation ($P < 0.002$).

3.2 | Complications and reoperations

The incidence of bleeding during the postoperative period was low in both groups, with no significant difference observed (Table 2). By contrast, a greater proportion of patients in the study group experienced tissue necrosis (2.5% skin necrosis and 2.3% nipple-areolar complex necrosis) compared to the control group, in which only one patient (0.1%) was diagnosed with this complication ($P < 0.001$).

TABLE 1 Clinical and care characteristics of study patients

	Total (*N* = 801) *n* (%)/mean ± SD	RM (*N* = 170) *n* (%)/mean ± SD	Tumorectomy (*N* = 631) *n* (%)/mean ± SD	*P*-value (RM vs tumorectomy)
Age (years)	58.0 ± 12.6	52.5 ± 10.0	59.5 ± 12.8	<0.001
BMI (kg/m^2)	26.9 ± 4.9	26.5 ± 4.5	27.1 ± 5.1	NS
Menstrual status				
Premenopausal	280 (34.9)	86 (50.5)	194 (30.7)	<0.001
Postmenopausal	521 (65.1)	84 (49.5)	437 (69.3)	
Tumor location				
Upper outer quadrant	423 (52.9)	61 (35.8)	362 (57.4)	
Upper inner quadrant	138 (17.2)	22 (12.9)	116 (18.4)	<0.001
Lower pole	193 (24.1)	70 (41.1)	123 (19.5)	
Retroareolar	47 (5.8)	17 (10.2)	30 (4.7)	
Tumor dispersion				
Unifocal	680 (84.8)	100 (58.8)	580 (91.9)	
Multifocal	100 (12.4)	51 (30.0)	49 (7.8)	0.02
Multicenter	21 (2.8)	19 (11.2)	2 (0.3)	
Primary chemotherapy				
Yes	129 (16.8)	38 (22.1)	91 (14.4)	
No	672 (83.1)	132 (77.9)	540 (85.6)	<0.001
Surgery duration (mins)	84.7 ± 46.4	153 ± 44.8	60.3 ± 25.1	0.0001
No. of interventions/patient	1.2 ± 0.5	1.2 ± 0.5	1.3 ± 0.5	NS
Hospital stay (days)	1.2 ± 1.4	1.8 ± 0.7	1.1 ± 1.8	0.001
Readmissions	8 (0.9)	3 (1.7)	5 (0.8)	NS
Time to adjuvant chemotherapy start after surgery (days)	62.3 ± 47.6	57.9 ± 31.6	58.1 ± 41.0	NS
Time to neoadjuvant radiation start after surgery (days)	62.7 ± 25.3	64.2 ± 30.6	67.0 ± 26.6	NS
Time to radiation start after surgery (days)[a]	70.7 ± 22.9	77.5 ± 16.6	67.3 ± 25.2	0.01
Radiotherapy				0.02
Breast	791 (98.7)	170 (100)	621 (98.4)	
Boost breast	310 (38.8)	78 (45.8)	232 (36.8)	
Armpit	164 (20.4)	53 (31.5)	111 (17.7)	
Supraclavicular	145 (18.1)	45 (26.9)	100 (15.9)	

NS, not significant; RM, reduction mammaplasty; BMI, body mass index.
[a]Patients with *ductal carcinoma* in situ or *invasive carcinoma* who did not receive adjuvant chemotherapy.

An extension of the edges was necessary in 8.9% of patients who underwent RM and 5.6% of patients who underwent tumorectomy, though this difference was not significant (Table 2). Of the 89 patients with a reoperation of the edges, 2 (2.24%) had a relapse in the breast. Rescue mastectomy was necessary in 2.9% and 3.8% of patients in the study and control groups, respectively, which ensured breast conservation was above 96% in both groups. The principal reason for mastectomy was the presence of DCIS in the new extended edges.

3.3 | Pathological study

The average weight of the surgical specimen in the study group was significantly higher than in the control group (229 g vs 32 g, respectively) ($P < 0{,}001$). Tumors from patients who underwent RM were larger, had more nodal involvement and were at a more advanced stage (Table 3). However, statistical comparisons of tumor subtypes between groups showed no significant differences.

3.4 | Oncologic outcomes

The events that occurred during the 10-year follow-up period (mean follow-up 84.4 ± 55.6 months; range: 2-202 months) are presented in Table 4. Overall, 32 disease recurrences were diagnosed, with a 10-year incidence of 9.8% and 5.1% for RM and tumorectomy patients, respectively ($P < 0.02$) (Fig. 1). A total of 16 patients developed metachronous tumors in the healthy breast, representing a 10-year actuarial incidence of 3.8% and 3.4% for RM and tumorectomy patients, respectively.

TABLE 2 Postoperative complications and reoperations due to margin involvement

	Total (*N* = 801) *n* (%)	RM (*N* = 170) *n* (%)	Tumorectomy (*N* = 631) *n* (%)	*P*-value (RM vs tumorectomy)
Reoperation for bleeding	8 (0.9)	3 (1.7)	5 (0.7)	NS
Mammary complications				
Hematoma	26 (3.2)	4 (2.3)	22 (3.4)	
Skin necrosis	5 (0.5)	4 (2.3)	1 (0.1)	
Nipple-areolar complex necrosis	4 (0.4)	4 (2.3)	0	<0.001
Infection	14 (1.7)	1 (0.5)	13 (2.0)	
Breast seroma	24 (2.9)	3 (1.7)	21 (3.3)	
Total	73 (9.1)	16 (9.5)	57 (9.0)	
Salvage breast surgery				
Margin expansion	60 (7.4)	15 (8.9)	45 (5.6)	
Mastectomy	29 (3.6)	5 (2.9)	24 (3.8)	NS
Final breast Conservation	772 (96.3)	165 (97.1)	607 (96.2)	
Causes of mastectomy				
Extensive DCIS	19 (2.3)	2 (1.1)	17 (2.6)	
Multifocal ILC	6 (0.7)	2 (1.1)	4 (0.6)	NS
Post-neoadjuvant PR	4 (0.4)	1 (0.5)	3 (0.4)	

RM, reduction mammoplasty; DCIS, ductal carcinoma in situ; ILC, infiltrating lobular carcinoma; NS, not significant; PR, partial response to neoadjuvant chemotherapy.

A total of 91 patients died during follow-up, but breast cancer was the cause in only 45 cases. The overall 10-year survival rate was 84.3%, and appeared to be higher in the RM group (90.4%) compared to the tumorectomy group (83.0%). However, this difference was not significant. Disease-free survival was more common in tumorectomy patients (82.2%) than in RM patients (75.4%) ($P < 0.03$). Patients with more advanced tumors at diagnosis presented worse SLE without significant differences between groups (Table 5).

3.5 | Satisfaction and quality of life

A total of 103 women (60.5%) who underwent RM completed the Breast-Q mastopexy questionnaire. For the remaining 67 who did not complete the questionnaire, the following reasons were given: the minimum follow-up of 1 year after breast irradiation was not completed (34 patients), death (10 patients), local relapse, and subsequent mastectomy (10 patients), declined to participate in this part of the study (13 patients). Overall, the mean scores for psychosocial status and satisfaction with the breast, evolution, and sexual sphere were 83, 82, 73, and 70 out of 100, respectively. The highest levels of satisfaction were recorded for the staff of our unit (97/100), the surgeon (96/100), and the nursing care (92/100).

4 | DISCUSSION

RM using the Wise excision pattern has long been the method of choice for treating macromastia in the field of cosmetic surgery.[14,15] Since the early '90s, its introduction into the context of oncologic surgery has been proposed as a way to facilitate breast remodeling after extensive resection[16] and as a surgical approach for tumors of the lower pole.[17] Currently, it is used as a complementary procedure to tumorectomy in the conservative management of breast cancer, with indications mainly relating to the resection of multifocal/multicentric tumors in areas at high-risk of deformity (lower pole, inner quadrants) and facilitation of radiation therapy in women with macromastia or gigantomastia. In our experience, RM makes up 17.8% of conservative procedures for breast cancer, and is performed in a patient population with a very distinct profile compared to patients who typically undergo tumorectomy. Most notably, RM patients are commonly young women with tumors of greater dispersion (multifocal) that are above average in size and located in the lower pole or inner quadrants.

RM has a similar rate of postoperative complications to tumorectomy, with a similar rate of bleeding. However, RM presents the risk of several specific complications which are not commonly encountered in tumorectomy, such as tissue necrosis, with the main perpetrator being necrosis of the nipple-areolar complex.[18] Such complications are reported to occur at an incidence ranging from 0.6%[19] to 4%[20] (2.3% in our experience), and their appearance does not lead to a delay in the initiation of adjuvant treatments when compared to tumorectomy.[21] Importantly, the incidence of postoperative complications appears to decrease if RM is performed immediately. In support of this, Egro et al[22] demonstrated that performing RM as a second intervention increased the incidence of complications to 33%, with this rising to 60% when performed after irradiation of the breast.

When analysing the effectiveness of RM for tumor extirpation, most studies report a rate of re-excision between 0%[23] and 16%.[24] Risk factors for re-excision are similar to those of tumorectomy and

TABLE 3 Results of the pathological study of surgical specimens

	Total (*N* = 801) *n* (%)/mean ± SD	RM (*N* = 170) *n* (%)/mean ± SD	Tumorectomy (*N* = 631) *n* (%)/mean ± SD	*P*-value (RM vs tumorectomy)
Surgical specimen mean weight (g)	112.5 ± 243.3	229.7 ± 344.4	32.4 ± 55.7	<0.001
Histological type				
DCIS	54 (6.7)	18 (10.5)	36 (5.7)	
IDC	632 (79.0)	137 (80.5)	495 (78.4)	NS
ILC	60 (7.5)	8 (4.8)	52 (8.3)	
Others	55 (6.8)	7 (4.2)	48 (7.6)	
Mean tumor size (cm)	1.4 ± 1.0	1.7 ± 1.3	1.3 ± 0.9	<0.001
Tumor size				
Tis	54 (6.7)	19 (10.6)	35 (5.6)	
T1	557 (69.6)	99 (58.9)	458 (73.0)	
T2	151 (18.9)	38 (22.4)	113 (18.0)	<0.001
T3	4 (0.5)	2 (1.1)	2 (0.4)	
Non-assessable (neoadjuvant)	35 (4.3)	12 (7.0)	23 (3.0)	
Axillary lymphadenectomy				
No	539 (67.3)	96 (56.5)	443 (70.2)	
Yes	262 (32.7)	74 (43.5)	188 (29.8)	<0.001
Lymph node involvement				
N0	549 (68.6)	107 (62.9)	442 (70.0)	
N1	188 (23.6)	48 (28.2)	140 (22.1)	<0.001
N2	48 (5.9)	13 (7.6)	35 (5.5)	
N3	16 (1.9)	2 (1.2)	14 (2.9)	
Tumor stage at intervention				
0	56 (6.9)	20 (11.8)	36 (5.8)	
I	465 (58.0)	74 (43.4)	391 (61.9)	<0.01
IIA	170 (21.3)	49 (28.8)	121 (19.2)	
IIB	51 (6.4)	12 (7.2)	39 (6.2)	
III	59 (7.4)	15 (8.8)	44 (6.9)	
Tumor subtype				
Luminal A	246 (30.7)	48 (28.2)	198 (31.4)	
Luminal B HER2 negative	208 (25.9)	50 (28.4)	158 (25.0)	
Luminal B HER2 positive	71 (8.9)	17 (10.0)	54 (8.5)	NS
HER2	40 (5.0)	11 (6.5)	29 (4.6)	
Triple negative	92 (11.6)	19 (11.2)	73 (11.5)	
Non-assessable[a]	144 (17.9)	25 (14.7)	119 (18.5)	

NS, not significant; RM, reduction mammaplasty; HER2, human epidermal growth factor receptor 2; DCIS, ductal carcinoma in situ; IDCI, infiltrating ductal carcinoma; ILC, infiltrating lobular carcinoma.
[a]Tumors without HER2 study during the period 2000-2004 and ductal carcinomas in situ.

relate to tumor histological factors. In women with breast cancer undergoing oncoplastic surgery, Clough et al[25] found that the risk of re-excision appeared to be increased in patients with invasive lobular carcinoma, larger tumors, or tumors of grade 1 and 2. However, multivariate analysis showed that only lobular carcinoma was an individual predictor of this outcome. Another factor influencing the rate of reoperation is the criterion used by the surgical unit to determine tumor margins: the more restrictive the criterion, the larger the rate of re-excision. Currently, the majority of breast units use the "no ink on tumor" criterion for assessing surgical margins,[26] allowing a decrease in the rate of reoperation and a more informed evaluation of the need for radiotherapy *boost*. Though not significant, a trend toward a higher rate of re-excision (8.9% vs 5.6%) and a higher rate of radiation *boost* (45% vs 36%) in the RM group compared to the tumorectomy group was seen in the present study. We believe this is likely to be related to a higher proportion of RM patients having multifocal tumors (41%) at more advanced stages. Finally, salvage mastectomy was seen to be a rare event after the completion of RM.

TABLE 4 Cancer events during follow-up

	Total (*N* = 801) *n* (%)	RM (*N* = 170) *n* (%)	Tumorectomy (*N* = 631) *n* (%)	*P*-value (RM vs tumorectomy)
Locoregional relapse				
Recurrence sick breast	32 (4.0)	10 (5.8)	22 (3.4)	
Metachronous healthy breast	16 (2.0)	2 (1.1)	14 (2.2)	
Radiation-induced Angiosarcoma	1 (0.1)	0	1 (0.1)	
Ipsilateral axillary recurrence	1 (0.1)	0	1 (0.1)	NS
Contralateral axillary recurrence	2 (0.2)	2 (1.1)	0	
Exitus				
Breast cancer	45 (6.9)	8 (6.2)	37 (7.1)	
Other cancer(s)	8 (1.2)	1 (0.7)	7 (1.3)	
No cancer	38 (5.8)	1 (0.7)	37 (7.1)	

NS, not significant; RM, reduction mammoplasty.

Its incidence has been reported to range from 0.7%[27] to 16%,[28] with >95% of the breast reportedly conserved in women with multifocal tumors.

Overall and disease-free survival after RM for breast cancer has not been properly assessed in the literature due to very few studies reporting medium- or long-term follow-up data and a lack actuarial survival calculations. Furthermore, a systematic review by Piper et al[18] highlights the inadequacy of absolute survival and recurrence data for assessing clinical outcomes in cancer patients and emphasizes the importance of actuarial survival analysis at 5 and 10 years. Studies by Emiroglu et al[29] and De Lorenzi[30] report 10-year disease-free survival rates to be 73.2% and 69.0%, respectively. These rates are very similar to those found in the present study. The worst disease-free survival observed in RM group may be secondary to more advanced stages of the disease. Most studies[31,32] report a low rate of local recurrences (0–7.8%), though have mean follow-up durations that are too short for meaningful analysis in oncological patients, with most lasting less than 50 months. The present study found that the rate of tumor recurrence in the irradiated breast increased during follow-up (especially from the sixth year after the intervention onwards) and stood at close to 10% at

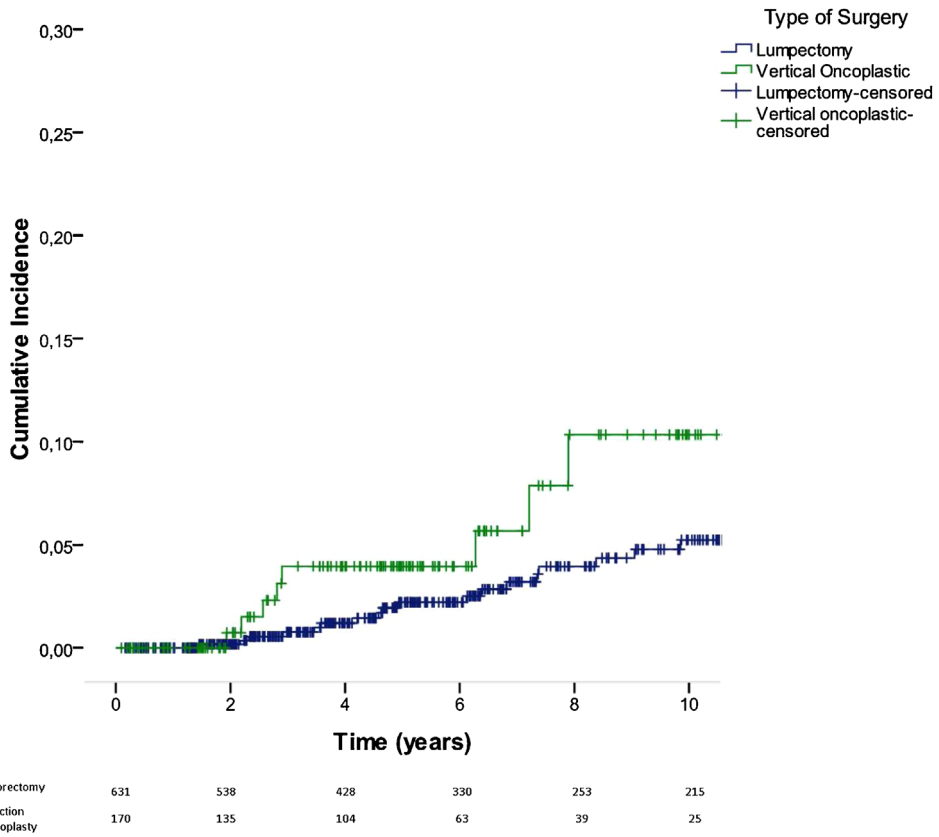

FIGURE 1 Actuarial incidence of local relapse by type of surgery

TABLE 5 Disease free survival by tumor stage and group

	5 years DFS		10 years DFS		
DFS	Tumorectomy	RM	Tumorectomy	RM	*P*
Stage 0	97.4% (94.9-99.9%)	81.6% (72-90.2%)	81.2% (70.5-91.9%)	-	NS
Stage I	94.5% (93.1-95.9%)	92.9% (89.4-96.4%)	87.5% (85.2-89.8%)	78.8% (71.6-86%)	NS
Stage IIA	88.9% (85.7-92.1%)	86.2% (80.4-92%)	85.4% (81.5-89.3%)	73.3% (63.6-83%)	NS
Stage IIB	85.9% (78.3-93.5%)	-	73.7% (63.4-84%)	-	NS
Stage III	73.2% (66.5-79.9%)	74% (62.8-85.2%)	52.2% (43.3-61.1%)	55.5% (37.4-73.6%)	NS

NS, not significant; RM, reduction mammoplasty; DFS, disease-free survival.

10 years. This is double the rate found in the tumorectomy group (5.1%) at 10 years. This increase in local relapse compared to tumorectomy may be partly due to the prevalence of multifocal and more advanced tumors in the RM group. Another influential factor may have been the completion of anti-hormonal treatment 5 years after surgery in women with luminal tumors.

There are only a few studies analyzing satisfaction and quality of life after RM in breast cancer patients. Most studies[33,34] address the use of this procedure in the context of cosmetic surgery, the aim of which is different from cancer surgery. This may explain the differences in satisfaction scores reported by oncological patients and individuals receiving RM for macromastia. The average satisfaction score in our RM patients (72.8) was lower than the 82% reported by Coriddi et al in a study of macromastia subjects.[35] These differences are likely to be due to a combination of the effects of radiation on the affected breast, the effects of adjuvant treatments (such as chemotherapy, hormonal therapy, and anti-bodies) on female body image and self-esteem, and the stressful experience of the diagnostic and therapeutic process of having breast cancer. In the present study, patient satisfaction with the information received and healthcare professionals was extremely high, particularly in terms of the surgeon and the breast unit (96 and 97 out of 100, respectively). These results reflect the importance of individualized care and multidisciplinary disease management in women with breast cancer. Regarding quality of life, our study found physical, and sexual well-being scores to be similar to those of subjects undergoing RM for macromastia.[35] This reflects a balance in the patient's self-esteem.

Our study has several limitations. It is a retrospective study with a design that does not allow determination of risk factors for reoperation or the emergence of local relapse. Furthermore, 39% of patients did not complete the Breast-Q questionnaire (several because they elected not to do so), which may have influenced our findings regarding satisfaction and quality of life.

In conclusion, RM is a useful procedure in the management of multifocal tumors of the breast as it guarantees a low rate of re-excision and mastectomy. Overall survival at 10 years appears similar to that associated with patients undergoing tumorectomy, though a relatively higher incidence of local recurrences was seen (9.8%, in our experience). The satisfaction and quality of life scores 1 year after RM surgery were found to be high.

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How to cite this article: Acea-Nebril B, Cereijo-Garea C, García-Novoa A, Varela-Lamas C, Builes-Ramírez S, Bouzón-Alejandro A, and Mosquera-Oses J. The role of oncoplastic breast reduction in the conservative management of breast cancer: Complications, survival, and quality of life. *J Surg Oncol*. 2017;9999:1–8. doi:10.1002/jso.24550.

SYNOPSIS

Reduction Mammaplasty allows mammary remodeling after wide excisions in breast cancer. Our study found that overall survival at 10 years is similar to that associated with tumorectomy with optimal satisfaction with the breast and a good quality of life, assessed using the BreastQ-questionnaire.